

(19) World Intellectual Property Organization  
International Bureau(43) International Publication Date  
11 December 2003 (11.12.2003)

PCT

(10) International Publication Number  
**WO 03/102492 A1**(51) International Patent Classification<sup>7</sup>: **F42B 12/40**

(21) International Application Number: PCT/GB03/02344

(22) International Filing Date: 30 May 2003 (30.05.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
0212612.6 30 May 2002 (30.05.2002) GB

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(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

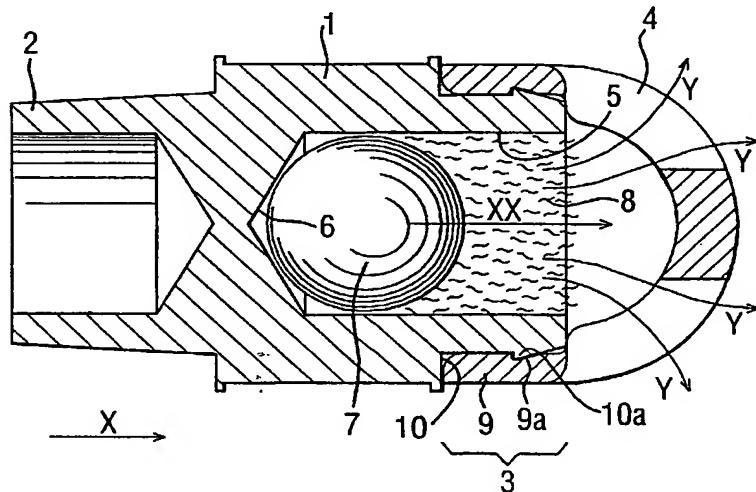
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MARKER PROJECTILE

**WO 03/102492 A1**

(57) Abstract: The invention provides a marker projectile comprising a hollow body (1) having an opening (5) at the front; marker substance (8) disposed within the hollow body (1); and an expelling member (7) such as a metal ball within the hollow body (1), behind the marking substance (8). The hollow body (1) and expelling member (7) being configured such that upon impact of the projectile with a target, the momentum of the expelling member (7) relative to the hollow body (1) carries the expelling member (7) forward to expel the marking substance (8) through the opening (5), and characterised by a separator (4) extending at least partly over the front opening (5), the separator (4) defining two or more spaces (42a, 42b, 42c) through which the marker substance may pass when expelled through the opening (5).

**MARKER PROJECTILE**

The present invention relates to a marker projectile and to the combination of a marker projectile and a cartridge.

5

**BACKGROUND**

Marker projectiles for use in training or war games are well known and examples of such projectiles are disclosed in US 4,686,905, GB 2 284  
10 252, GB 1 263 522, US 3,528,662, US 4,128,059 and US 3,782,286.

Most of the aforementioned patents disclose projectiles in which a marker substance is held within a frangible casing or enclosure which ruptures upon impact with a target. A problem with projectiles such as  
15 bullets that are intended to break upon impact is that sometimes they fail to break. Moreover, because of the high impact required to break the frangible casing or enclosure, the projectiles can often cause injury upon impact with a person. A further problem is that the frangible casings or enclosures can sometimes break in a gun during the gun's reloading  
20 cycle.

Some of the aforementioned problems are addressed in GB 2 284 252 which discloses a projectile comprising a hollow casing having a perforated nose portion, a piston disposed within the casing, and a marking substance disposed forwardly of the piston. The piston is movable forwardly under force applied to it by gas used to discharge the projectile thereby compressing the marking substance and expelling it through the nose portion which thus becomes coated with the marking substance. Upon impact with a target, the marking substance is  
30 transferred

to the target to mark the target.

However, a problem with projectiles, such as those disclosed in GB 2 284 252, in which the nose portion of the projectile is coated with a marking substance even before the projectile has left the gun barrel, is that the marking substance is dispersed by the rotation imparted to the projectile by the rifling in the gun barrel. Thus, the centrifugal force imparted by the spinning bullet causes the marking substance to move radially outwardly and consequently it can foul the barrel of the gun. A build up of marking substance, or its thermal decomposition products, in the gun barrel over time will inevitably have an adverse effect on the working of the gun. This problem is greatly exacerbated with bullets designed for use in high velocity rifles such as the NATO and US 5.56mm calibre rifles where the rifling in the barrel must be such as to impart a very high spin rate to the bullet in order to ensure a stable trajectory. Even with relatively low velocity training ammunition, the high spin rates imparted by the rifling in high velocity rifles are still sufficient to cause the marking substance to disperse in the manner described above.

A still further problem with the marker projectile of GB 2 284 252 and other known marker projectiles is that they are unsuitable for small calibre barrels such as the current NATO and US 5.56mm calibre self loading rifle barrels. This is not only because of the problem of radial dispersion of the marking substance referred to above, but also because the complexity of the bullet poses considerable manufacturing difficulties with smaller calibre bullets.

International Patent Application no. PCT/GB00/00241 discloses a marker projectile which goes some way to overcoming the aforementioned technical problems. The marker projectile in that patent

specification is characterised by a marker substance being disposed in a hollow chamber with a front opening. An expelling member is positioned behind the marker substance with respect to the front opening. The configuration of the projectile is such that, on impact with a target, the  
5 momentum of the expelling member relative to the hollow body carries the expelling member forwardly towards the impacted target so as to expel the marking substance in a low impact manner. These marker projectiles are distinguished from known projectiles such as those disclosed in GB 2 284 252 where a piston within the projectile is driven  
10 forwardly by the propellant gases in the cartridge or gun to expel the marker substance. In the projectiles described in PCT/GB001/00241, the expelling member is insulated from the propellant gases; in other words, the propellant gases do not act on the expelling member to force it forwardly to cause expulsion of the marking substance.

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The present invention aims to improve the spread of a marker substance expelled by a non-lethal, low impact projectile of the type already described in PCT/GB00/00241.

20 **SUMMARY OF THE INVENTION**

In accordance with the present invention, there is provided a non-lethal marker projectile comprising a hollow body having an opening at the front; a marker substance disposed within the hollow body; and an  
25 expelling member within the hollow body behind the marking substance; the hollow body and expelling member being configured such that upon impact of the projectile with a target, the momentum of the expelling member relative to the hollow body carries the expelling member forwardly to expel the marking substance through the opening and  
30 characterised by a separator extending at least partly over the front

opening, the separator defining two or more spaces through which the marker substance may pass when expelled through the opening.

The separator may conveniently be provided in the form of a cap  
5 which is secured to an outer wall or edge of the hollow body adjacent the front opening. Desirably, such a cap is secured in such a way that the aerodynamic properties of the projectile are not significantly compromised. The separator conveniently comprises one or more arms extending between the periphery of the front opening and the centre of  
10 the front opening. Optionally, the arms extend symmetrically from the centre to the periphery of the opening. Preferably, there are between two and four arms, desirably, there are three arms. Optionally, the separator has a domed configuration, the peak of the dome sitting in substantial alignment with the centre of the front opening.

15

Conveniently, a collar at the end of the hollow body adjacent the opening is provided with a peripheral protrusion, such as an angled flange, over which a complementary inner surface of the separator may be snap fit into position. Alternative means for securing the separator to  
20 the hollow body will not doubt occur to the skilled addressee and may, without limitation, include; providing complementary screw threads so that the separator can be screwed into position on the body, press fitting, spot welding, gluing or clipping.

25

The provision of the separator causes the marker substance, when propelled by the expelling member to be separated by a barrier (such as an arm) provided by the separator and to be expelled through the available spaces between elements of the barrier. This causes spreading of the marker substance over the target area, in a manner similar to

water flowing through a sprinkler head. The mark on the target becoming more visible from a distance.

In one embodiment, the hollow body comprises a sleeve having a core body portion secured within a rear end thereof, the inner wall of the sleeve and a forwardly facing surface of the core body portion defining a chamber within which the marking substance and expelling member are disposed. The sleeve typically has a cylindrical form, a spigot portion of the core body member being received (preferably non-slidably) within the rear end of the sleeve. The sleeve is preferably formed from a material having a greater density than the material from which the core body portion is formed. Thus, for example, the sleeve can be formed from a metal material such as aluminium and the core body portion can be formed from a plastics material. The advantage of this feature is that (with the exception of the expelling member) the mass of the hollow body is concentrated towards its outer circumference which improves its ballistic properties.

It is most preferred that the hollow body is provided with means for centring the expelling member therein during flight of the projectile. By providing centring means, lateral movement of the expelling member during flight is prevented and the destabilising effect of such movement is therefore avoided. The centring means can be a recess in a forwardly facing surface within the interior of the hollow body. Where the hollow body comprises a core body portion and a sleeve, the centring means can comprise a recess in the forwardly facing surface of the core body portion. The recess constituting the centring means can be conical, frustoconical, hemispherical or part hemispherical, for example.

The expelling member can take a variety of shapes provided that it is rotationally symmetrical about its longitudinal axis. Preferably, it is of a spherical shape and more preferably it is a solid sphere.

5       The expelling member is typically formed from a material having a greater density than the material(s) from which the hollow body is formed. Thus, for example, the expelling member can be formed from steel. Where the projectile comprises a sleeve and core body portion, it is preferred that the expelling member has a greater density than the sleeve  
10      and the core body portion. It will appreciated also that, typically, the expelling member will have a density greater than the density of the marking substance.

15      In order to ensure that the expelling member can be carried forwardly by its own momentum within the hollow body upon impact with a target without its motion being retarded by frictional engagement with an inner surface of the hollow body, there is preferably a radial clearance between the centred expelling member and the inner wall of the hollow body (e.g. sleeve) sleeve.

20

In the projectiles of the invention, the motivating force urging the expelling member forwardly against the marking substance is the expelling member's own momentum. There is no need for a piston/cylinder arrangement driven by the expanding propellant gases  
25      within the gun barrel upon firing. On the contrary, where a core body portion/sleeve arrangement is used, means are typically provided for preventing forward movement of the core body portion in the manner of a piston relative to the sleeve. Such means can take the form of an abutment surface, for example an abutment flange, on the core body  
30      portion which rests against a rearwardly facing surface of the sleeve.

The present invention also contemplates the combination of a cartridge and a marker projectile as hereinbefore defined.

5    **BRIEF DESCRIPTION OF THE DRAWINGS**

For the purposes of exemplification, a preferred embodiment of the invention is now described with reference to the following Figures in which:

10

Figure 1 shows a longitudinal section through one embodiment of a projectile of the invention;

15

Figure 2 shows in more detailed view, from three perspectives, the separator which distinguishes the projectile of the invention from the prior art.

**DESCRIPTION OF THE PREFERRED EMBODIMENT**

20

As can be seen in Figure 1, the projectile comprises a main body 1 having a tail portion 2 for seating in an appropriately configured cartridge (not shown), and a front portion 3 to which a separator 4 is secured. In the front portion 3 and behind the separator 4 is a hollow, generally cylindrical recess 5 having a tapered bottom 6. Seated within the recess 5, is an expelling member, represented as a ball bearing 7. Also within the recess but between the separator 4 and the ball bearing 7 is a quantity of marker substance 8.

The separator 4 is substantially dome shaped in profile and has a collar 9 configured to snap fit over a recessed portion 10 of an outer wall of the body 1 adjacent the front portion 3. The recessed portion 10 is provided with radially outwardly extending protrusions 10a, which are 5 received in complementary indentations 9a positioned radially on an inner wall of the collar 9.

When the projectile of the embodiment of Figure 1 is propelled from a gun (in a direction indicated by arrow X), the ball bearing 7 which 10 is relatively heavy compared to the body of the projectile is slower to start moving and hence is carried with the projectile, retaining its position to the rear of the recess 5. When the projectile impacts a target or other object, the body 1 is stopped in its tracks, however, momentum built up by the ball bearing 7, causes it to continue its path (as indicated by arrow 15 XX) and to move inside the body 1 towards the front portion 3, forcing the marker substance 8 to be expelled through the front portion 3. As the marker substance 8 passes through the front portion 3, it encounters the separator 4 and is thereby spread through spaces 4a, provided in the separator 4, as indicated by arrows Y.

20

Figure 2 shows three views, a longitudinal section (a) and an end view (b) of the separator 4 of Figure 1, lastly, shown in (c), is a section through the plane A-A of view (b).

25 As can be seen from end view (b), the separator is made up of three arms 41a, 41b, and 41 c, all extending from a common centre 40 of the separator 4, to the collar 9. The collar and arms define between them 3 spaces 42a, 42b and 42c through which the marker substance 8 is spread in use.

30

It is to be understood that the foregoing is purely exemplary of just one embodiment of the invention others of which will no doubt occur to the skilled addressee without departing from the true scope of the invention as defined by the appended claims.

**CLAIMS**

1. A non-lethal marker projectile comprising a hollow body having an opening at the front; a marker substance disposed within the hollow body; and an expelling member within the hollow body behind the marking substance; the hollow body and expelling member being configured such that upon impact of the projectile with a target, the momentum of the expelling member relative to the hollow body carries the expelling member forwardly to expel the marking substance through the opening and characterised by a separator extending at least partly over the front opening, the separator defining two or more spaces through which the marker substance may pass when expelled through the opening.  
5
2. A non-lethal marker projectile as claimed in claim 1 characterised in that the separator comprises a cap which is secured to an outer wall or edge of the hollow body adjacent the front opening.  
10
3. A non-lethal marker projectile as claimed in 2 characterised in that cap is secured in such a way that the aerodynamic properties of the projectile are not significantly compromised.  
15
4. A non-lethal marker projectile as claimed in any preceding claim characterised in that the separator comprises one or more arms extending between the periphery of the front opening and the centre of the front opening.  
20
- 25
- 30

5. A non-lethal marker projectile as claimed in claim 4 characterised in that the arms extend symmetrically from the centre to the periphery of the opening.
- 5
6. A non-lethal marker projectile as claimed in claim 4 or claim 5 characterised by between two and four arms.
7. A non-lethal marker projectile as claimed in claim 6 characterised in that there are three arms.
- 10
8. A non-lethal marker projectile as claimed in any preceding claim characterised in that the separator has a domed configuration, the peak of the dome sitting in substantial alignment with the centre of the front opening.
- 15
9. A non-lethal marker projectile as claimed in any preceding claim characterised in that the hollow body is provided with means for centring the expelling member therein during flight of the projectile.
- 20
10. A non-lethal marker projectile as claimed in claim 9 characterised in that the centring means is a recess in a forwardly facing surface within the interior of the hollow body.
- 25
11. A non-lethal marker projectile as claimed in any one of the preceding claims characterised in that the hollow body comprises a sleeve having a core body portion secured within a rear end thereof, the inner wall of the sleeve and a
- 30

forwardly facing surface of the core body portion defining a chamber within which the marking substance and expelling member are disposed.

5        12. A non-lethal marker projectile as claimed in claim 10 or 11 characterised in that the recess is conical, frustoconical, hemispherical or part hemispherical.

10      13. A non-lethal marker projectile as claimed in any of claims 10 to 12 characterised in that the sleeve has a cylindrical form, and a spigot portion of the core body member is received within the rear end of the sleeve.

15      14. A non-lethal marker projectile as claimed in any one of claims 10 to 3 characterised in that the sleeve is formed from a material having a greater density than the material from which the core body portion is formed.

20      15. A non-lethal marker projectile as claimed in 14 characterised in that the sleeve is formed from a metal material and the core body portion is formed from a plastics material.

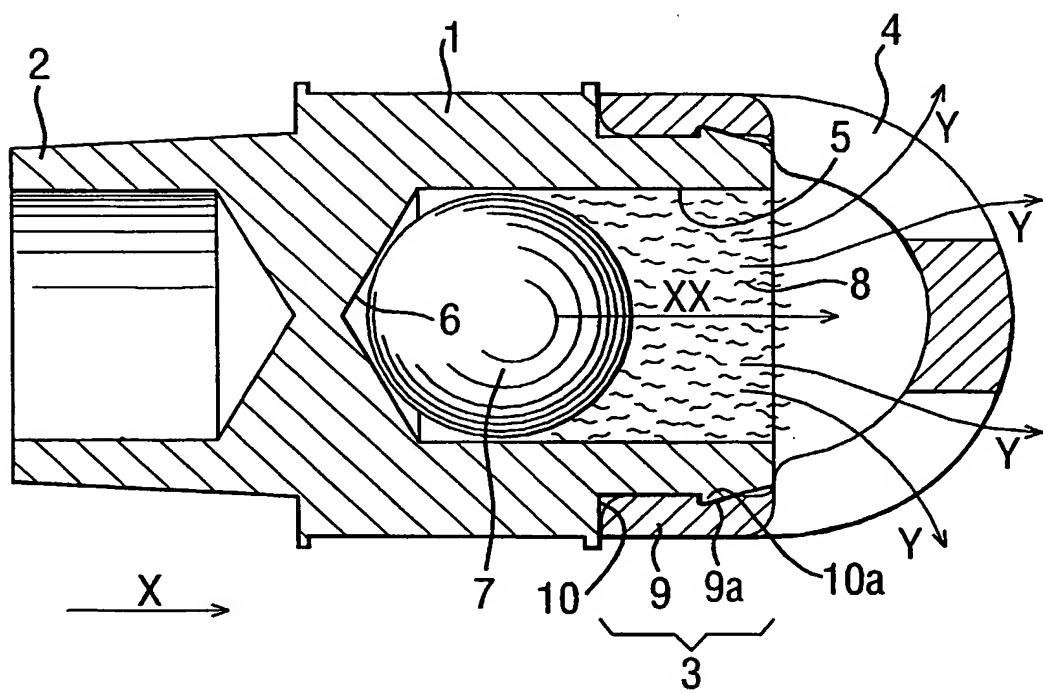
25      16. A non-lethal marker projectile as claimed in 15 characterised in that the sleeve is formed from aluminium.

17. A non-lethal marker projectile as claimed in any one of the preceding claims characterised in that the expelling member is formed from a material having a greater density than the material(s) from which the hollow body is formed.

18. A non-lethal marker projectile as claimed in claim 17 characterised in that the expelling member is formed from steel.

1/2

FIG. 1



2/2

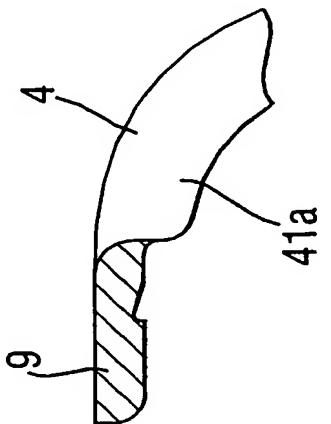


FIG. 2c

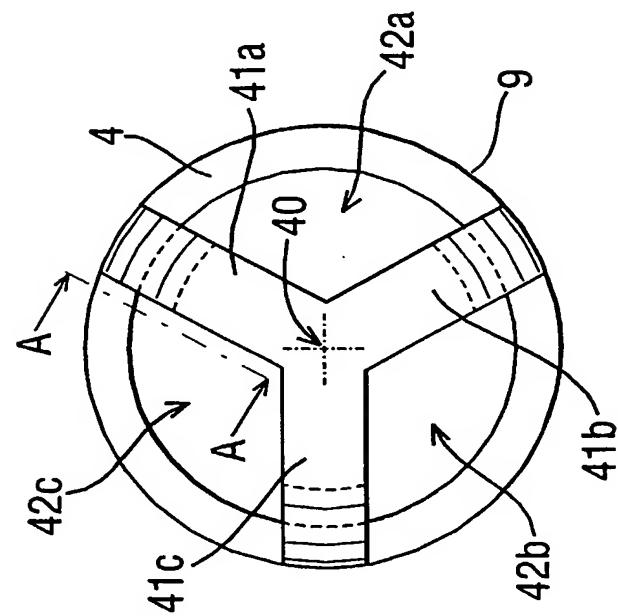


FIG. 2b

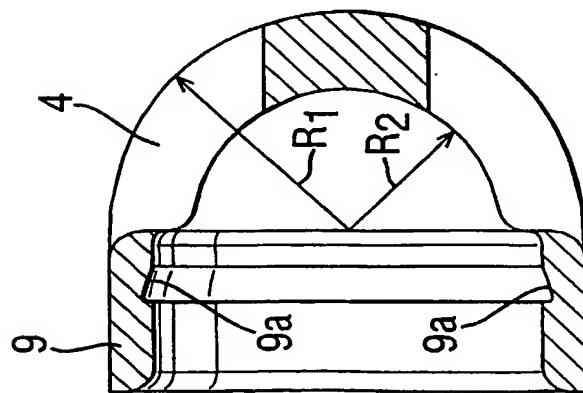


FIG. 2a

## INTERNATIONAL SEARCH REPORT

Internal	Application No
PCT/GB 03/02344	

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F42B12/40

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F42B F41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 14903 A (SAXBY MICHAEL ERNEST ;CONSTANTIA INT LTD (GI)) 1 June 1995 (1995-06-01) page 1, line 29 -page 2, line 27; figures -----	1,2,4-18
A	FR 2 762 385 A (DENIS JEAN PIERRE) 23 October 1998 (1998-10-23) page 5, line 21 -page 7, column 2; figure 3 -----	1

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

## \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

8 October 2003

Date of mailing of the international search report

30/10/2003

Name and mailing address of the ISA

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# INTERNATIONAL SEARCH REPORT

Inter

application No.  
GB 03/02344

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.: 3 because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
  
3.  Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

The additional search fees were accompanied by the applicant's protest.  
 No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB 03 02344

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 3

Present claim 3 relates to a product defined by reference to a desirable characteristic or property, namely that the aerodynamic properties of the projectile are not significantly compromised.

An attempt is made to define the product by reference to a result to be achieved. Additionally it is not clear which properties are not to be compromised and in which degree as to result significant. This lack of clarity in the present case is such as to render a meaningful search over the whole of the claimed scope impossible. Consequently, the search has been carried out for those claims which appear to be clear, supported and disclosed, namely claims 1, 2 and 4 to 18, inasmuch as not depending on claim 3.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

## INTERNATIONAL SEARCH REPORT

Information on patent family members

Internal Application No

PCT/GB 03/02344

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